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OCCUPATIONAL EXPOSURE TO NOISE

EVALUATION AND CONTROL

CONTENTS PAGE

1. GENERAL 1
2. HEALTH ASPECTS 1
3. POTENTIAL SOURCES 2
4. LEGAL REQUIREMENTS 3
5. SPECIFIC RESPONSIBILITIES 6

1. GENERAL

1.01 This section provides information and guidelines on the evaluation and control of noise in the work place, as required by the Occupational Safety and Health Administration (OSHA) and published in 29CFR 1910.95 and the appendixes.

1.02 When this section is reissued, the reasons for reissue will be given in this paragraph.

1.03 Commonly used terms are defined as follows:

Action Level: A noise exposure of 85 dBA averaged over an 8-hour period. Triggers certain compliance requirements.

Audiogram: A chart or graph of hearing threshold levels as a function of frequency, produced as a result of professionally administered testing.

dB: Decibel. A dimensionless unit used to express sound levels. Zero dB is the weakest sound that can be heard by a person with very good hearing in an extremely quiet location.

dBA: The dB measure of sound levels using instrumentation calibrated with a standard "A-weighted" network (electronic). The "A" network is designed to approximate sensitivity variations of the human ear at typical sound levels of industrial noise.

Dose: Noise exposure index. Determined by adding all noise levels over a given time period. Usually expressed as a percentage of the permissible exposure limit (PEL).

Dosimeter: A standard instrument which integrates the occurrence and duration of noise. Registered readings are based on the "dose" concept.

HCP: Hearing Conservation Program. A program mandated by OSHA for all employees occupationally exposed to noise above the action level.

Noise: Disturbing, harmful, or unwanted sound.

Noise-Induced Hearing Loss: The cumulative, permanent loss of hearing that develops over months or years of hazardous noise exposure.

OSHA: Occupational Safety and Health Administration.

PEL: Permissible exposure limit for noise. Established by law as 90 dBA averaged over an 8-hour period.

SLM: Sound level meter. A standard instrument used to measure the intensity of sound at a given moment.

STS: Standard threshold shift. A change in hearing threshold of a given level at particular frequencies with reference to an established baseline.

TWA: Time weighted average. The average level of noise during a specific time period.

2. HEALTH ASPECTS

2.01 Sound is defined as the sensation experienced when varying fluctuations in air pressure (waves) strike the mechanisms of the human ear.

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2.02 Sound waves may vary in intensity (loudness) and in frequency (pitch).

2.03 The human ear is a delicate mechanism enabling an individual to detect sound waves and convert them to electrical impulses that are transmitted to the brain for interpretation.

2.04 There are three basic parts to the human ear. Extremely simplified, their functions are as follows:

(1) ***Outer (External) Ear:*** Collects sound waves and funnels them to the eardrum, causing the eardrum to vibrate.

(2) ***Middle Ear:*** Transfers sound energy from the eardrum via a series of tiny bones which, in turn, amplify the sound and transfer the vibrations to the wall of the inner ear.

(3) ***Inner Ear:*** Vibrations from the middle ear set the inner ear fluids in motion. This motion causes a shearing movement on inner ear hair cells. These hair cells are connected to nerve endings and their movement triggers electrical impulses which are transmitted to the brain.

2.05 The normal hearing process of the young ear detects sounds in a range of frequencies from 20 to 20,000 hertz (Hz).

2.06 Hearing ability gradually deteriorates as a part of the aging process. This loss of hearing acuity with age is quite normal in the higher frequencies (10,000 Hz and above) but rarely causes serious personal and social handicaps until it occurs in the normal speech range (300 to 4000 Hz).

2.07 The sense of hearing is a complex process and is susceptible to impairment from a variety of sources. These sources may be physical, from skull fractures or blows to the head; middle or inner ear infections; hereditary; nerve damage, as may be caused by certain drugs; simple blockages; or excessive noise.

2.08 Hearing impairment as a result of excessive noise exposure (noise-induced hearing loss) is not uncommon in the work place.

2.09 Outer and middle ear structures are rarely damaged by intense sound energy, although explosions can cause ruptured eardrums. The most common damage from excessive work-place noise involves injury to the hair cells of the inner ear.

2.10 Hearing loss or a shift in the hearing threshold as a result of noise exposure most commonly occurs first at frequencies near 4000 Hz.

2.11 Noise-induced threshold shifts may be either temporary (TTS) or permanent (PTS).

(a) ***Temporary*** threshold shift may be caused by a brief exposure to high-level sound. It is greatest immediately after the exposure and diminishes as the ear recovers from the overstimulation.

(b) ***Permanent*** threshold shift is similar to TTS except that hearing recovery is not complete.

2.12 Some of the variables contributing to hearing threshold shifts involve sound intensity (loudness), frequency (pitch), duration of exposure, and variations in individual tolerances.

2.13 Of special note is the fact that noise-induced hearing loss is progressive. While susceptibility varies from one individual to another, above certain levels of high intensity, all individuals are susceptible.

2.14 In noisy environments, if hearing acuity is not monitored, it may easily go unnoticed since pain, a common indicator that some form of trauma has occurred, is absent.

3. POTENTIAL SOURCES

3.01 The operating telephone companies, unlike many industrial work-place environments, have few jobs which may involve exposure to noise above the action level.

3.02 A reasonable estimate of an environment which should be considered "suspicious" is any environment where normal speech is not easily understood. If it requires more than normal effort to understand speech when conversants are in close proximity (2 feet or less), the noise level may be approaching a critical level.

3.03 For reference purposes, the level of some typical sounds is as follows:

- 0 dB: Defined as the threshold of hearing
- 30 dB: Soft whisper (5 feet)
- 60 dB: Conversational speech (3 feet)
- 80 dB: Average factory or very noisy restaurant
- 90 dB: Subway or printing press plant
- 100 dB: Looms in textile mills
- 120 dB: Hydraulic press
- 140 dB: Jet plane.

3.04 Bell Laboratories and the operating telephone companies have performed noise monitoring in a variety of work areas to assist in identifying potentially exposed employees.

3.05 Employees engaged in the following telephone company activities, under certain circumstances, may possess a potential for overexposure to noise:

- Outside craft, especially heavy equipment operators, or while in the vicinity of heavy equipment
- Standby generator operation
- Coin counting
- Heating, ventilating, and air conditioning equipment maintenance
- Mail room activities (automatic printers).

3.06 Further potential overexposures may exist for personnel who work in noisy customer premise environments. These areas are usually easily identified by difficulty in conversation (see paragraph 3.02), posted warning signs, or hearing protection in use.

4. LEGAL REQUIREMENTS

4.01 The OSHA standard for occupational exposure to noise is published in its entirety in 29CFR 1910.95 and Appendixes A through I. On March 8, 1983, the original standard was amended with the publishing of a final rule on hearing conservation. The purpose of paragraphs 4.02 through 4.16 is to outline current requirements as they apply to the operating telephone companies.

> ***Note:*** Specific explanatory information is contained in the appendixes to the standard. Accordingly, Appendices A through E are designated as "mandatory" and F through I "nonmandatory," or informational only. The subjects covered are as follows:
>
> Appendix A — Noise Exposure Computation
>
> Appendix B — Estimating Adequacy of Hearing Protector Attenuation
>
> Appendix C — Audiometric Measuring Instruments
>
> Appendix D — Audiometric Test Rooms
>
> Appendix E — Acoustic Calibration of Audiometers
>
> Appendix F — Audiogram Corrections for Aging
>
> Appendix G — Monitoring Noise Levels—Information
>
> Appendix H — Document Availability
>
> Appendix I — Definitions.

4.02 The purpose of the standard is the reduction of hearing impairment caused by exposure to harmful noise levels in the work place.

4.03 The ***permissible exposure level (PEL)*** for noise is 90 dBA as an 8-hour time weighted average (TWA). Typically, the level of occupational noise varies during a 8-hour period. Table A shows limits of exposures at different levels of intensity which are equivalent to an 8-hour TWA of 90 dBA.

TABLE A

PERMISSIBLE DURATION (HOURS)	SOUND LEVEL (dBA)
32	80
24	82
16	85
12	87
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4 or less	115

Note: For each increase of 5 dBA, the permissible exposure duration is halved. For each decrease of 5 dBA, it is doubled.

4.04 When daily noise exposures are composed of one or more periods of noise at different levels, their combined effect is considered according to the formula:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} --- + \frac{C_n}{T_n} = \text{Dose}$$

Where C_1, C_2---C_n are the durations of exposure at a specific level and T_1, T_2---T_n are the total durations of exposure permitted at that level. When the sum equals or exceeds one, the PEL has been exceeded.

4.05 When employees are exposed to sound exceeding the PEL, feasible administrative or engineering controls must be utilized. If controls fail, hearing protection must be provided to reduce exposures below the PEL.

4.06 The ***action level*** for occupational exposure to noise is established at an 8-hour TWA of 85 dBA (50 percent of the PEL, or a dose of 0.5). ***Employees exposed at or above the action level must be placed in a Hearing Conservation Program (HCP) at no personal cost.*** Requirements of an HCP are contained in paragraphs 4.07 through 4.16.

4.07 When information indicates that an employee's exposure may equal or exceed the action level, noise monitoring must be performed. Monitoring must be done, using calibrated instruments, and followed up whenever changes in processes increase noise exposures to the extent that additional employees may be exposed or hearing protection provided may be inadequate. Either area or personal monitoring, as appropriate, may be used and all sound from 80 to 130 dB must be integrated into the measurements.

4.08 Each employee exposed at or above the action level must be informed of the monitoring results. The time frame and notification means are not mandated but it is recommended that the notification be prompt and written.

4.09 Affected employees or their representatives must be provided with the opportunity to observe monitoring.

4.10 ***An audiometric testing program*** must be established and maintained for all employees exposed at or above the action level. Tests must be professionally administered in a specific manner, using precisely calibrated instruments, and in a test room with limited background noise. Other elements of the testing program include:

(a) Within 6 months of initial exposure at the action level, a valid ***baseline audiogram*** must be established for subsequent audiogram comparisons.

(b) At least annually after obtaining a baseline audiogram, employees exposed at or above the action level shall be provided a new audiogram.

(c) Each annual audiogram must be compared to the baseline to determine if a standard threshold shift (STS) has occurred. If so:

(1) The employer may obtain a retest within 30 days and consider the retest as the annual audiogram.

(2) Unless it can be established that the STS is not work-related or work-aggravated, employees not using hearing protection must be fitted with them, trained in their use and care, and required to use them.

(3) Employees already using hearing protection must be refitted, retrained, and offered protectors providing greater attenuation if necessary.

(4) Employees shall be referred for further evaluation if it is suspected that a medical pathology of the ear is caused or aggravated by the use of hearing protection.

(d) If audiometric testing of an employee exposed to an 8-hour TWA of less than 90 dBA indicates the STS is not persistent, the employee must be notified and hearing protector use may be discontinued.

(e) An annual audiogram may be submitted for the baseline when it is determined that the STS is persistent or when the annual audiogram indicates significant improvement over the baseline.

Note: A standard threshold shift (STS) is a change in hearing threshold relating to the baseline of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear. Corrections for aging, as described in Appendix F of the standard, may be applied in determining if an STS has occurred.

4.11 ***Hearing protectors*** must be made available to all employees who are:

(a) Exposed at or above the action level

(b) Exposed at or above the PEL

(c) Exposed at or above the action level and have not yet had a baseline audiogram

(d) Exposed at or above the action level and have experienced an STS.

4.12 Employers must provide a variety of protectors to choose from; provide training in the use, care, and fitting; and in the cases of (a), (b) and (c) in paragraph 4.11, ensure that they are worn.

4.13 The hearing protector attenuation must be adequate to reduce exposure below the PEL, or to the action level for employees who have experienced STS.

4.14 A ***training program*** must be instituted for all employees exposed at or above the action level. The training program must be repeated annually and include:

(a) The effects of noise on hearing

(b) All aspects of the use of hearing protectors (ie, advantages, disadvantages, attenuation, selection, use, fitting, and care)

(c) Explanation and purpose of audiometric tests.

4.15 ***Access to information and training materials*** shall be provided by the employer to affected employees or their representatives.

4.16 The employer is required to keep records associated with occupational noise exposure as follows:

(a) Exposure measurements (see paragraph 4.07)—2 years

(b) Audiometric tests—duration of affected employee's employment. The record must include:

(1) Name and job class

(2) Date of audiogram

(3) Examiner's name

(4) Date of last audiometer calibration

(5) Employee's most recent noise exposure assessment

(6) Background sound levels in audiometric test rooms.

(c) Employees or employees' representatives are guaranteed access to records as provided for in 29 CFR 1910.20.

5. SPECIFIC RESPONSIBILITIES

5.01 Overall responsibilities of the operating telephone companies which are administered jointly by the office of the District Staff Manager—Safety and the Medical Department include:

(a) Overall legal responsibility for providing and maintaining a work place where employees are protected from the effects of occupational noise exposure above the PEL

(b) Institution of engineering or administrative controls, employee information and training, hearing protection devices, and implementation of a Hearing Conservation Program (HCP) as required

(c) Continued monitoring of controls and programs to ensure their effectiveness.

5.02 Local supervisory responsibility in pursuit of corporate goals includes:

(a) Dissemination of employee information and implementation of training programs on the hazards of occupational noise exposure

(b) Recognition of unusually noisy environments so employees can be protected from excessive exposures

(c) Enforcement of hearing protector use as required by law.

5.03 Personal responsibilities of each employee potentially exposed to excessive occupational noise include:

(a) Taking advantage of controls and/or protective devices to protect against noise-induced hearing loss

(b) Prompt reporting of questionable environments so protective measures can be taken

(c) Continued cooperation with management to ensure effectiveness of programs undertaken.